repairing any leaks discovered during said testing,

then attaching a first core retaining plate to said first outer core plate and a second core retaining plate to said second outer core plate, each said core retaining plate having a first end extending beyond a first end of said core and a second end opposite said first end extending beyond a second end of said core, and

then assembling a first and second flow compartments between said first end of said core and said first ends of said core retaining plates and third and fourth flow compartments between said second end of said core and said second ends of said core retaining plates.

24. The heat exchanger as set forth in claim 23 wherein the step of building a heat exchanger core includes the steps of:

providing a flat first outer core plate,

stacking a plurality of spaced inner core plates on said first core plate with a pair of longitudinal edge spacers disposed between each pair of adjacent inner core plates and extending along the edges of said inner core plates,

stacking a flat second outer core plate on said inner plates opposite said first core plate,

welding said first core plate, said inner plates, said edge spacers and said second core plate together to form an all welded heat exchanger core.

REMARKS

Amendment to Specification and Drawings

The specification and drawings are amended to correct the reference numbers. Specifically, Figure 2 is amended so that the number 16 designates connector 16 as disclosed at page 3, line 16 and the number 46 designates end portion 46 of plate 42 as disclosed at page 5, line 13. Figure 2 is also amended to correct the position of section line 6-6 at the end of the heat exchanger core. Figure 3 is amended to correct the "HOT IN" and "HOT OUT" designations and the reference numbers 16 and 17 to be consistent with Figures 1 and 2. Figure 4 is amended to show the correct cross section at the break away, consistent with the inner plates as shown in Figure 9. Figure 6 is amended to show the section for Figure 6A. Figures 6-9 are amended to designate the two different inner plates 26 and 27, as originally shown. Several corrections of the reference numbers are made in the specification.

The specification is amended at page 4, lines 14 to 32, to correct the description the inner plates as shown in Figure 9. Figure 9 shows two distinct inner plates. Rotation of the upper inner plate about the x, y or z axis will not provide the shown lower inner plate. The upwardly inclined sections and downwardly inclined sections of the upper inner plate and lower inner plate shown alternate. The specification is amended to describe the alternating plates.

Claims Pending

Claims 1-24 are pending in this application. Claims 6 and 12 are amended to claim the alternating inner plates as originally disclosed in Figure 9, and as explained above.

New Claims

Claims 20-24 have been added to more adequately protect the invention. Claim 20 is dependent from Claim 1 and claims the all welded construction of the heat exchanger of the present invention. Claim 21 is a method claim and Claim 22 is dependent from Claim 21. Claim 23 is a product-by-process claim and Claim 24 is dependent from Claim 23.

Claims rejected under 35 U.S.C. § 103(a)

Apparatus Claims

Claims 1-5 are rejected under 35 U.S.C. § 103(a) as being unpatentable over French Patent No. 1,389,833 to Rosenblad, particularly in view of U.S. Patent No. 5,469,914 to Davison et al. Claim 1 is an independent claim and Claims 2-5 are dependent claims dependent from Claim 1. Claims 6-11 are rejected under 35 U.S.C. § 103(a) as being unpatentable over French Patent No. 1,389,833 to Rosenblad, particularly in view of U.S. Patent No. 5,469,914 to Davison et al, and further in view of U.S. Patent No. 2,596,008 to Collins and U.S. Patent No. 5,303,771 to Des Champs. Claim 6 is dependent from Claim 1 and Claims 7-11 are ultimately dependent from Claim 6. Claims 12 and 13 are rejected under 35 U.S.C § 103(a) as being unpatentable over the combined teachings of Hulswitt et al., Davison et al. and Des Champs. Claim 13 is dependent from independent Claim 12.

Briefly stated, in accordance with the present invention there is disclosed a heat exchanger with a separately constructed ,leak tested core, first and second core retaining plates, and first and second end

wall portions. The heat exchanger core has first and second core plates and a stack of inner plates between the core plates that define flow passages. First and second core retaining plates are affixed to opposite faces of the core after the core is leak tested. The core retaining plates extend beyond the ends of the core and each has a pair of apertures. First and second end wall portions are connected to the core retaining plate at each end of the core to form flow compartments. Flow connectors extend into each of the apertures of the core retaining plates and are welded thereto. The outer core plates are thicker than the inner core plates, as shown, for strength to withstand pressure during testing. The inner plates of the core have upwardly inclined and downwardly inclined sections along each end with each inclined section having a flat terminal section that butts against and is welded to a terminal section on an adjacent inner plate.

The Figures of the French Patent to Rosenblad do not disclose a separate heat exchanger core with two core plates and a stack of inner plates. Davison et al. does not disclose a separate heat exchanger core with two core plates and a stack of inner plates. The combination of the references does not disclose a separate core. The combination of the references does not disclose a heat exchanger with a core with core plates and inner plates, and core retaining plates. Neither reference discloses a leak tested core. The description in the U.S. patent to Rosenblad does not teach a separate core or the definition of a leak tested core. Neither Collins nor Des Champs teach a separate core with core plates and inner plates, and

core retaining plates. Neither Collins nor Des Champs teach a separately constructed core or a leak tested core. Neither Hulswitt et al., Davison et al., nor Des Champs teach or suggest inclined sections with flat terminal sections.

Claim 1 defines a heat exchanger having a separately constructed, leak tested core with first and second core plates and a stack of inner plate. The heat exchanger of Claim 1 also has first and second core plates and first and second end portions. The combination of Rosenblad and Davison et al. does not teach the core of Claim 1, nor the separately constructed and leak tested core, nor the core retaining plates. Since Rosenblad and Davison et al. combined do not teach all of the elements or all of the definitions of Claim 1, it is submitted that Claim 1 is not obvious in view of Rosenblad and Davison et al.., and therefore dependent Claims 2-11 are also not obvious in view of these references.

The heat exchanger core of the present invention is leak tested before final assembly of the heat exchanger. Leak testing the core allows repair of the core before permanent assembly of the outer portions of the heat exchanger. The quality of the finished heat exchanger of the present invention is significantly higher than prior known heat exchangers. Articles may be claimed as "product-by-process". Also, product-by-process language may be used to define elements of a device, particularly where the subject matter can not be described in terms of its structure or properties.

If a significant number of heat exchangers are made without leak testing there will be a finite

number, however small, of leaks. If the heat exchangers have a leak tested core, there will be zero leaks. Therefore the "leak tested heat exchanger core" of Claim 1 is structurally different from the heat exchangers disclosed in the references.

The heat exchangers of the cited references do not have separate cores and would be difficult or impossible to leak test before final assembly of the heat exchanger. Known methods of testing require isolating either the hot or cold passages and pressurizing the passages, typically with air. If the pressure is maintained the isolated passage do not leak. Alternately, after pressurizing either the hot or cold passages, the heat exchanger can be submerged in a liquid so that bubbles indicate leaks. The heat exchanger taught by Rosenblad can not be leak tested before the core retaining plates are affixed since the flexible plates taught will not withstand any pressurization without the outer plates. The outer retaining plates of Davison form part of the flow passages, preventing leak testing before affixing the outer plates.

Applicant submits it is error to dismiss the applicant's definition of a leak tested core. This definition is not taught or suggested by Rosenblad or Davison and further distinguishes the present invention.

Claim 6 includes all of the definitions of Claim 1 and further defines the upwardly and downwardly inclined sections with flat terminal sections along each end of the inner plates. Rosenblad, Davison et al, Collins and Des Champs combined do not teach the

separately constructed, leak tested core, nor do these references teach the further definitions of Claim 6, the inclined sections with terminal sections. It is submitted that Claim 6 is not obvious in view of Rosenblad, Davison et al, Collins and Des Champs, and therefore dependent Claims 7-11 are also not obvious in view of these references.

Claim 12, as amended, defines a heat exchanger with downwardly inclined sections along about one half of each end of each inner plate and upwardly inclined sections along the other half of each end of each inner plate, each inclined section having a flat terminal section that is welded to a terminal section on an adjacent inner plate to form end closures for the flow passages. Hulswitt et al., Davison et al. and Des Champs do not teach or suggest the flat terminal sections on the inclined sections or the welding of these terminal sections. The invention claimed in Claim 12, with the inclined sections with the terminal sections, requires half the welds for end closure required by the heat exchanger of Hulswitt. The end closure taught by Davison is asymmetrical and can withstand less stress than the end closure of the present invention. The end closure taught by Davison does not have the terminal sections of the present invention so the welder must weld into a V instead of a Y. Thus the metal flows away from the weld and can create a gap or leak. This increases the difficulty of welding the end closure and produces a joint that is much less reliable than the joint of the present invention. Des Champs does not teach the terminal portions and does not suggest welding the end closures.

Applicant submits that the invention claimed in Claim 12 and, with further definitions, in Claim 13 is not obvious from the above cited references.

Method Claims

Claims 14-19 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Davison et al, in view of Peze et al.. Claim 14 is an independent claim and Claims 15-19 are dependent from Claim 14. Briefly, Claim 14 defines a method of making a heat exchanger including providing a heat exchanger core with first and second core plates and a stack of inner plates, adding first and second core retaining plates to the core after testing the core, and providing end portions to form flow compartments. Davison nor Peze together do not teach or suggest providing a heat exchanger core with first and second core plates and a stack of inner plates, testing the core, and then adding the two core retaining plates and the end portions.

Davison discloses a heat exchanger with two plates, a stack of inner plates and end portions to form flow compartments. Davison teaches, at col. 3, lines 4-7, that when the plate pack is tightened to a final dimension the sides are welded. Davison teaches welding the inner plates and the core retaining plates at the same time. Davison does not provide a separate core or leak test the core before final assembly. Davison does not suggest providing a separate core or testing the core before final assembly. The heat exchanger as taught by Davison does not have a core that can be tested.

Peze teaches welding inner plates and adding, but not attaching, two core retaining plates. Peze does not disclose providing a core with two core plates and inner plates, testing the core and then adding two core retaining plates. In Peze, since the core retaining plates are required for pressurization of passages B, col. 4, lines 29-38, the core cannot be tested prior to adding the core retaining plates. Davison and Peze combined simply do not teach or suggest the claimed steps of Claim 14.

A prerequisite to testing a heat exchanger core before assembly of the heat exchanger is providing a core that can be tested. Since none of the cited references teach or suggest providing such a core, it cannot be obvious to combine the step of testing the core with any of the references. Applicant submits that the invention claimed in Claim 14 is not obvious from the cited references. Since Claims 15-19 are dependent from Claim 14, it is further submitted that these claims are not obvious from the cited references.

Conclusion

As claims 2-11 depend from claim 1, believed allowable, it is submitted these are allowable as further dependents of an allowable generic claim. It is also submitted that independent Claims 12 and 14 are allowable, and Claim 13, dependent from Claim 12, and Claims 15-19, dependent from Claim 14, are also allowable. Reconsideration and allowance of claims 1-24 is respectfully requested in view of the foregoing remarks.

Enclosed is a check in the amount of $126.00 to cover the fee for two additional independent claims and four claims over twenty total claims. If the amount of the fee is in error, please charge any amount due or credit any overpayment to Deposit Account No. 06-0788.

Should any issues remain that would preclude prompt allowance of this application, it is requested that the Examiner contact the undersigned attorney by telephone.

Respectfully submitted,

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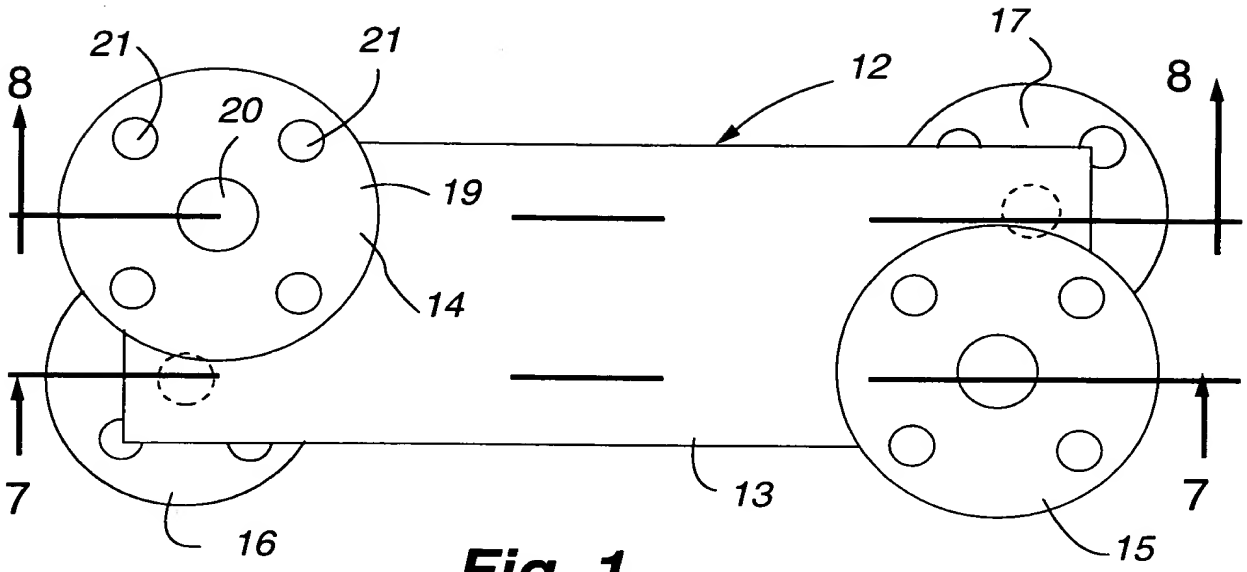
21
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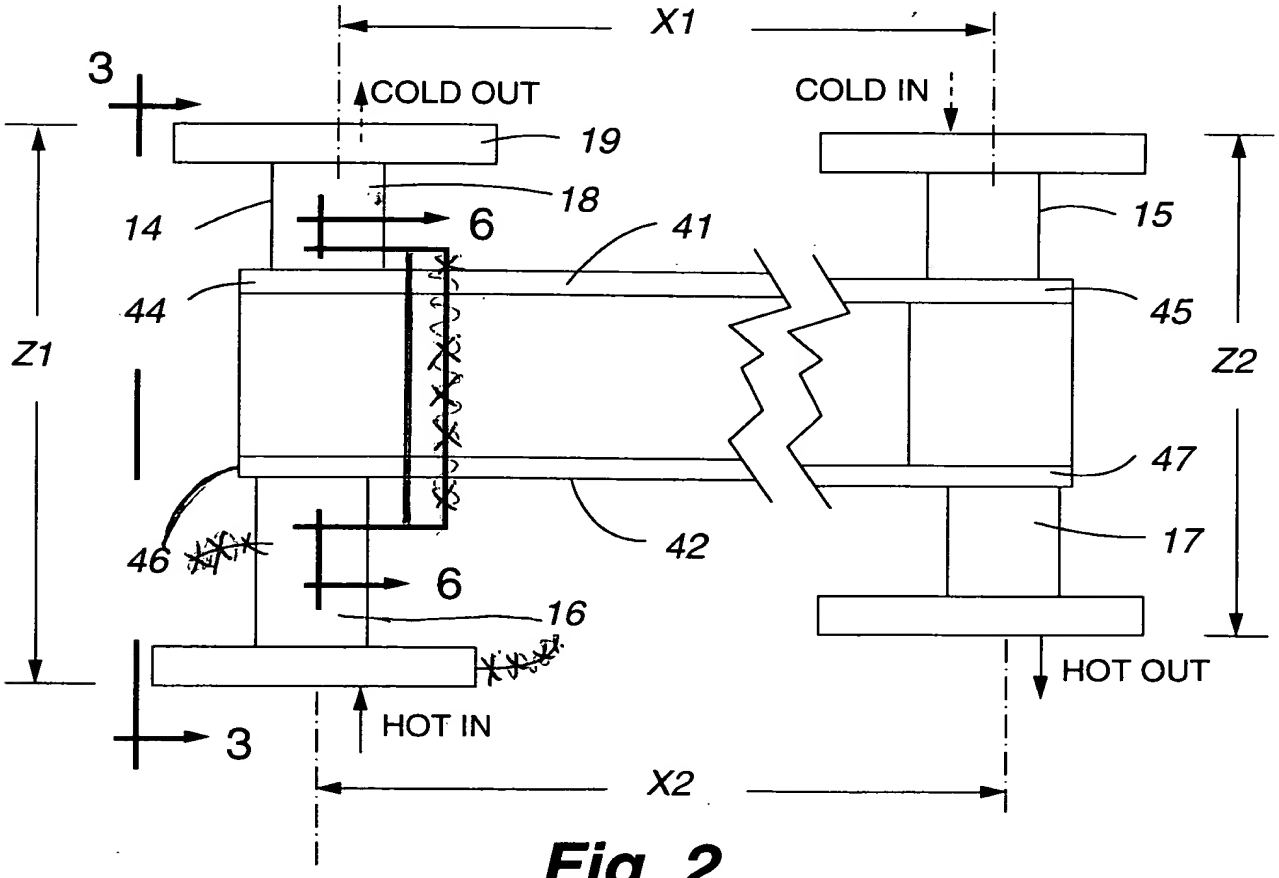
17
12
8
8
20
19
14
7
7
13
16
15

Fig. 1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3
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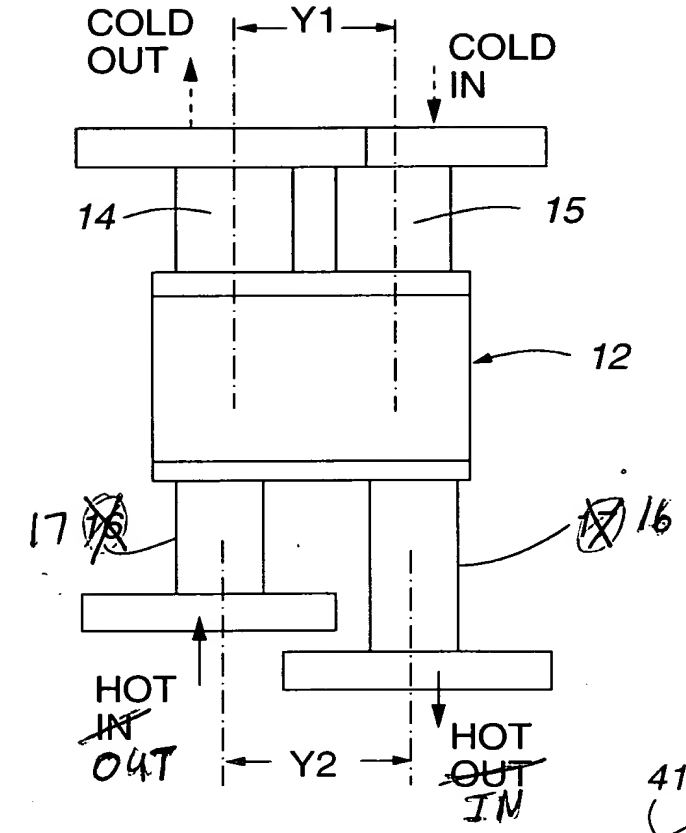
COLD IN
19
18
14
6
41
15
44
45
Z1
Z2
47
46
42
17
6
16
HOT OUT
HOT IN
3
X2

Fig. 2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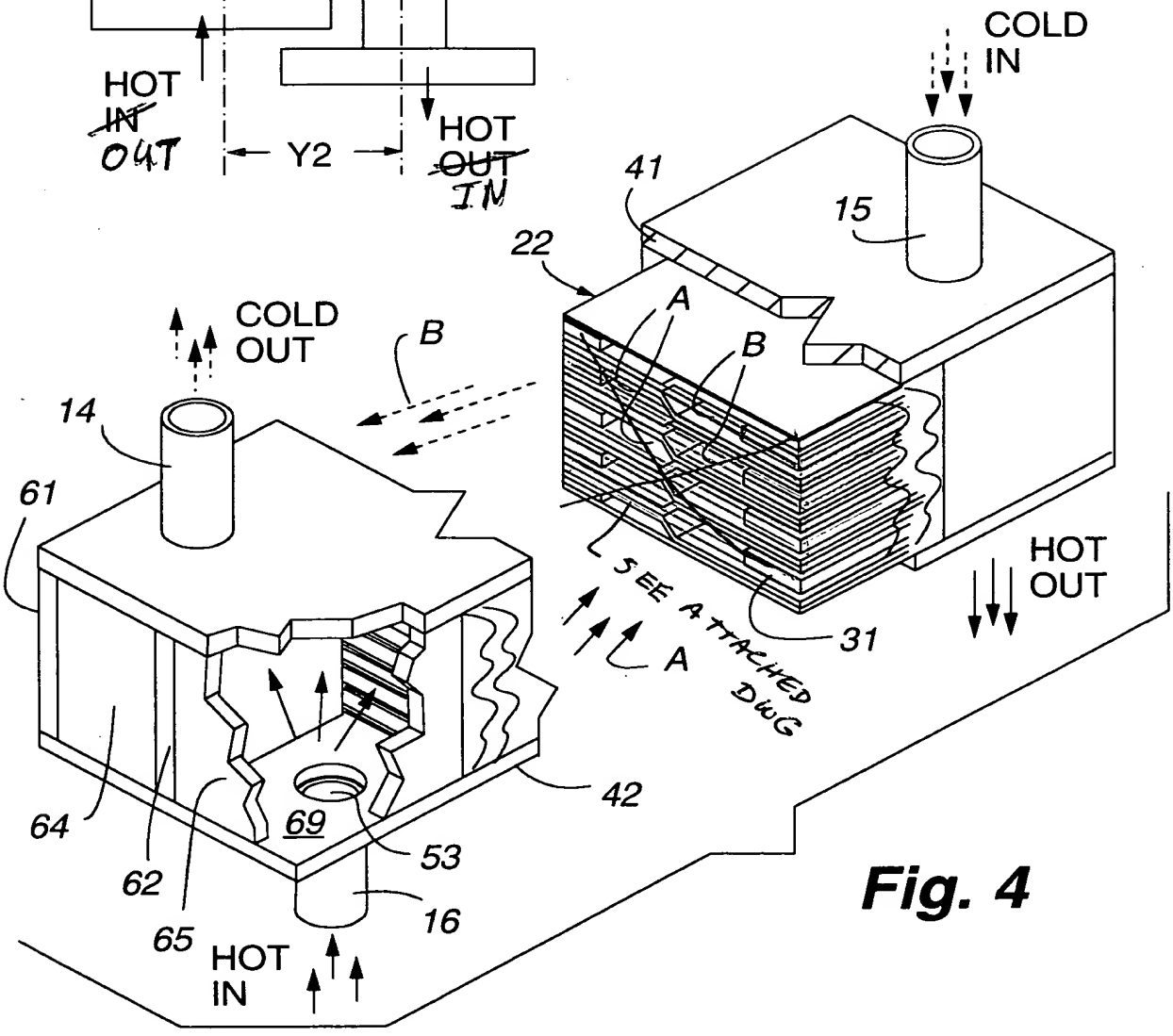
Y1
COLD
IN
14
15
12
17
16
HOT
IN
OUT
Y2
HOT
OUT
IN

Fig. 3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15
22
A
B
COLD
OUT
B
14
61
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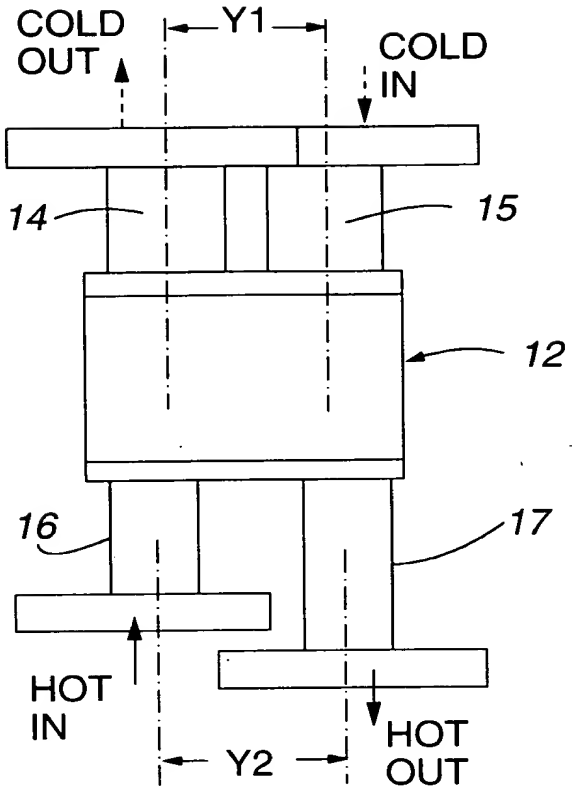
OUT
SEE ATTACHED DWG
A
31
42
64
69
53
62
16
65
HOT
IN

Fig. 4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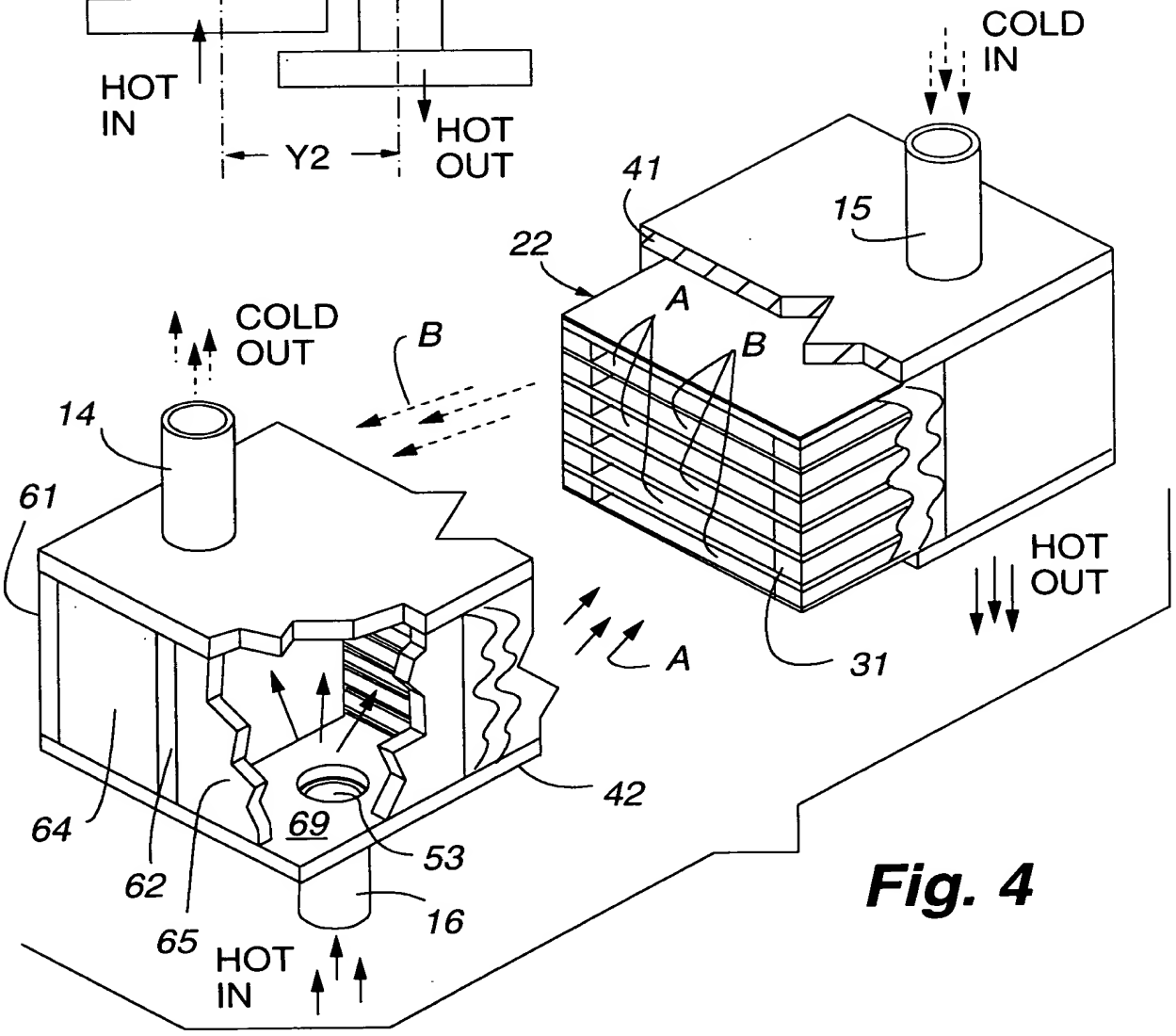
Y1
COLD
IN
14
15
12
16
17
HOT
IN
Y2
HOT
OUT

Fig. 3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15
22
A
B
COLD
OUT
B
14
61
HOT
OUT
A
31
42
64
69
53
62
16
65
HOT
IN

Fig. 4

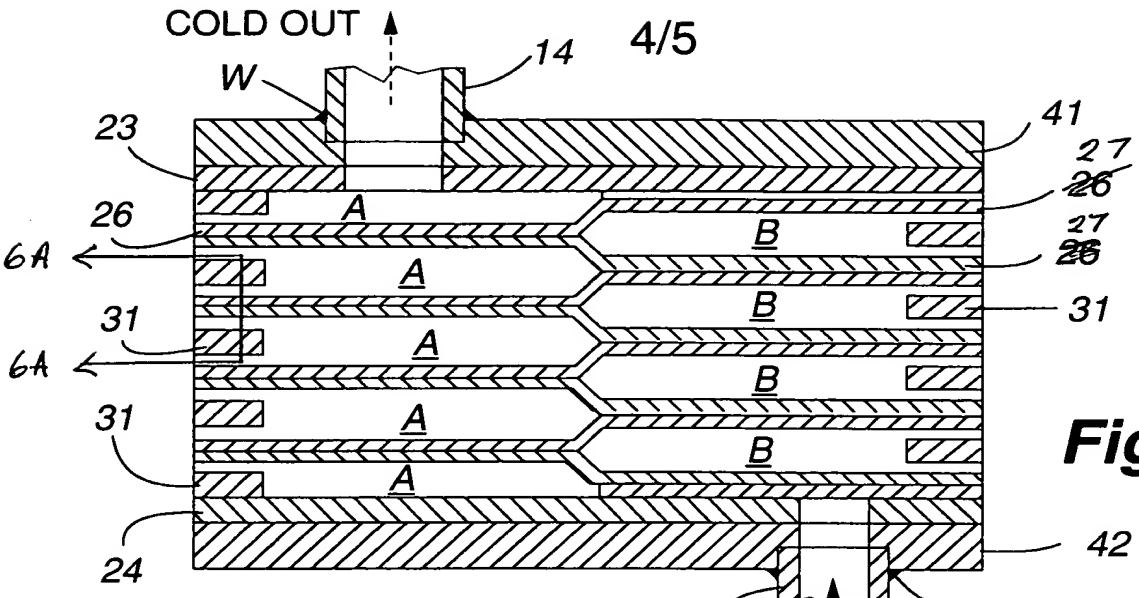

Fig. 6

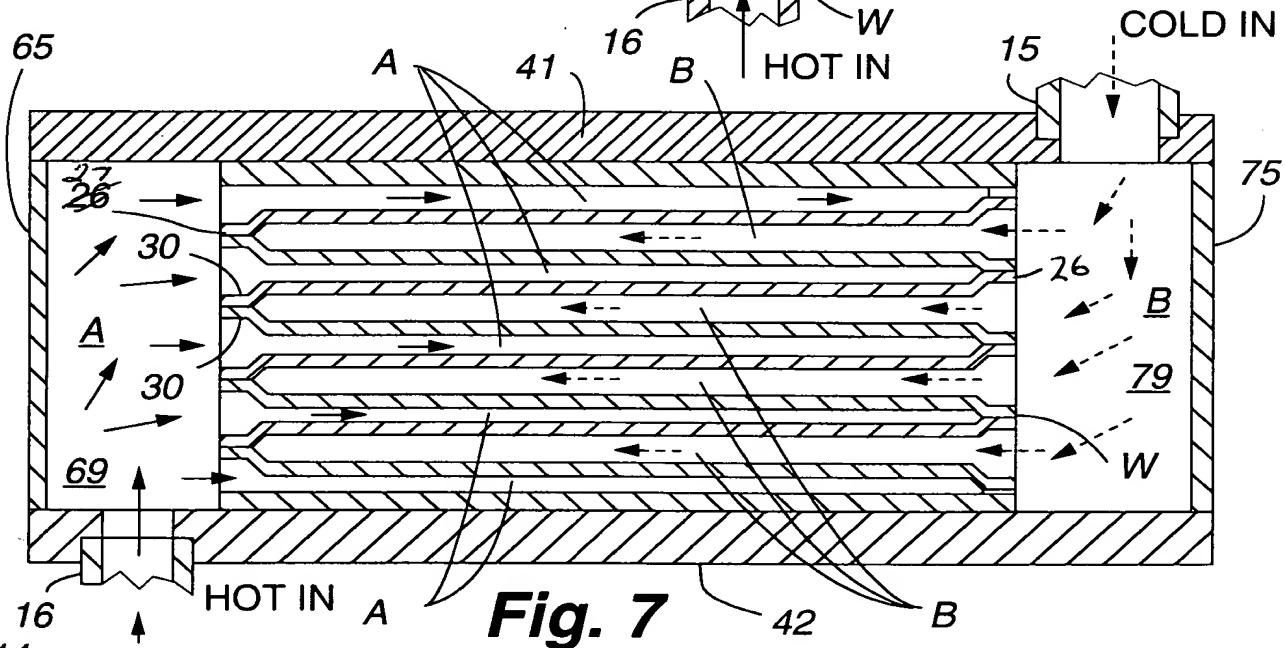

Fig. 7

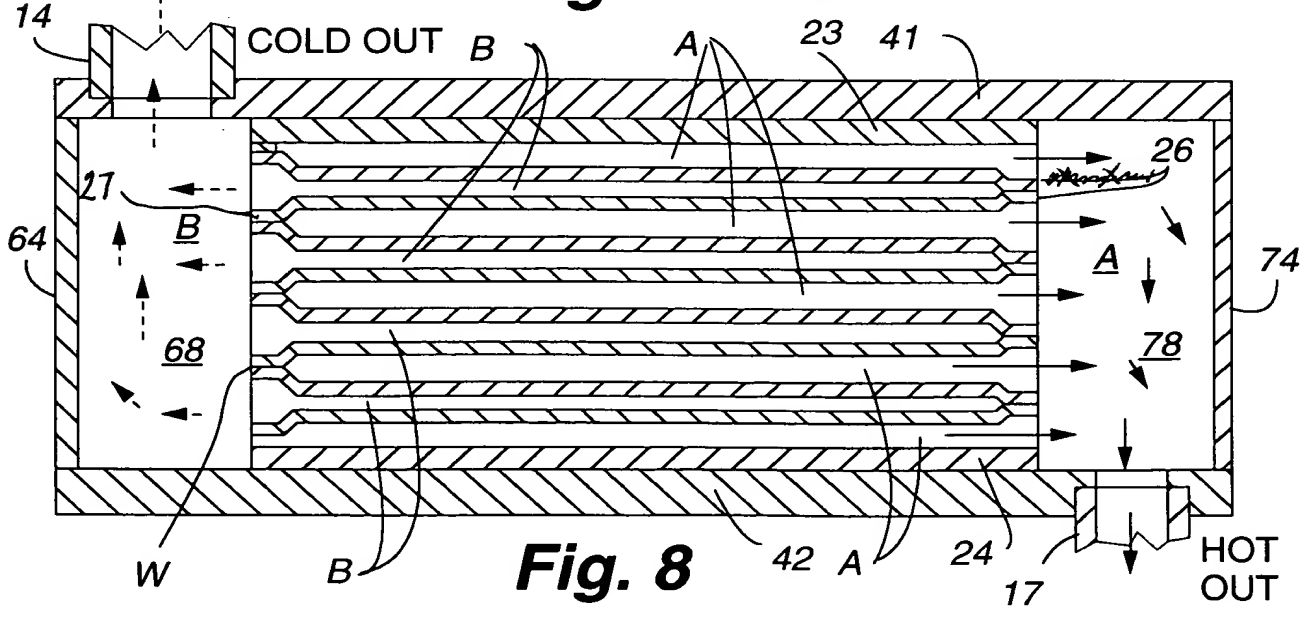

Fig. 8

FIG. 9

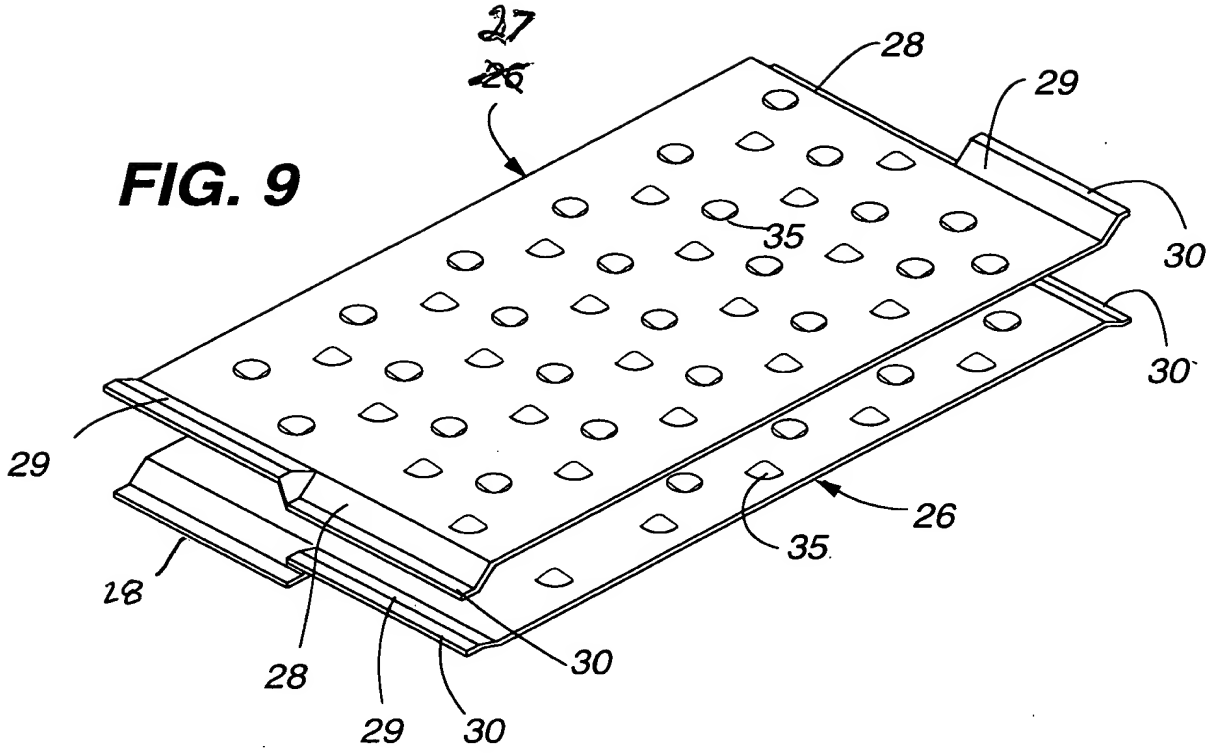

FIG. 10